The instruments are sent well packed to the observer *with a small spike and instructions for mounting it*, which in our case are the following:

INSTRUCTIONS FOR MOUNTING THE BAROMETER.

1. Mark your height on the wall where the instrument is to be placed.
2. Nail the small spike 8 centimeters above the mark, so as to place the center of dial at the same height of your eyes.

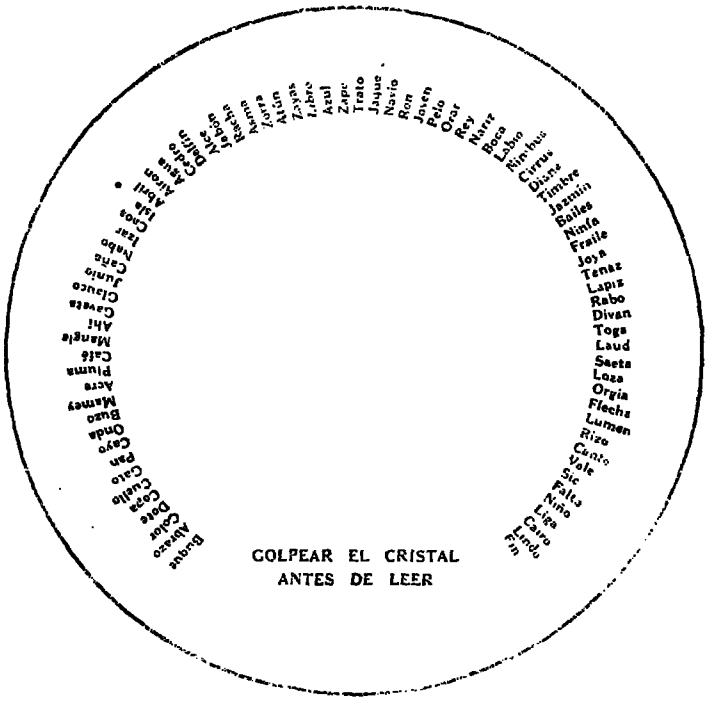

FIG. 1.—Dial for aneroid barometer used in the Cuban Meteorological Service.

Besides, in the letter to the future observer we recommend to him to place his head in such a position that he may see by reflection his eyes in the instrument, avoiding as far as possible parallactic errors.

The instruments are sent to any place without knowing the height above sea level. In fact, we do not care about this, as measures will be expressed finally to correspond to those of mercurial barometers, corrected for temperature, sea level, and normal gravity.

Of course, we have to depend on readings of mercurial barometers for the determination of the constant of each instrument. We proceed in the following manner:

Readings are taken at 7 a. m. and a value is assigned to the word sent each day from the isobar that crosses the place of the observer. In normal weather, 20 observations will suffice to eliminate all errors of drawing of isobars and give a very approximate value for a chosen word. For instance, suppose the observations sent are the following:

[Distance between words=1 mm.]

	Words received.	Value assigned.	Reduction to a chosen word on the basis of each value assigned.
June 1	toga	762.5	toga=762.5
June 2	togalaud	763.1	toga=762.6
June 3	laud	763.7	toga=762.7
June 4	toga	762.1	toga=762.1
June 5	divan	761.8	toga=762.8
June 6	divanrabo	761.1	toga=762.6
June 7	rabo	760.0	toga=762.0

The mean of 20 readings will give a fair value for the reading "toga" at this special place. Then all other values for the station are inserted and the instrument can then render service. Other determinations of the constant for the word chosen can be made from time to time.

We have found this to be the most economical and exact procedure of obtaining air pressure observations from nontechnical observers.

It might be mentioned that this device of introducing the code directly in the instrument could be utilized also in wind direction and velocity. We intend to do so in the future.

In developing this system the writer had the valuable assistance of Mr. Miguel Gutierrez Cenizos, observer of the Observatorio Nacional of Cuba.

THUNDERSTORMS OF JULY 13, 1922, IN THE DISTRICT OF COLUMBIA, MARYLAND, AND VIRGINIA.

By ALFRED J. HENRY, Meteorologist.

[Weather Bureau, Washington, D. C., August 15, 1922.]

The series of thunderstorms that occurred on July 13, 1922, as well as others which have been experienced during the present season, clearly lacked the usual evidence of a definite movement from one point of the compass to another that is a characteristic of thunderstorms in this vicinity. It has seemed rather that the storms have developed directly over the city and spread locally from that point as a center. The usual progression of thunderstorms in the vicinity of Washington is from the northwest to the southeast.

The object of this note is to ascertain whether the usual statistics on the occurrence of thunderstorms in the adjoining States of Maryland and Virginia would throw any light of a definitive character upon the progression of the thunderstorms of July 13, 1922.

Meteorological conditions.—At 8 a. m. of the date in question a trough of low pressure stretched from the mouth of the St. Lawrence southwestward to the Carolinas. This trough was flanked on either side by higher pressure, the level of the barometer at the center of the respective anticyclones being 30.30 inches. The winds were south to west in the trough and northerly on its western margin. The temperature at 8 a. m. at Washington, Baltimore, and in southeastern Pennsylvania was 80° or above and the humidity was relatively high, both conditions being favorable to the development of thunderstorms later in the day.

The beginning of the storm at Washington, D. C.—The first thunder was heard at 4 p. m. and rain began 5 minutes later. The local sky signs, however, indicated that preliminary thunderstorm activity had been in progress over the city for at least an hour. At 3:05 p. m. thunder was heard to the east of the station, but further development of this disturbance ceased. At 3:30 p. m. typical thunderstorm clouds appeared to the southwest and these thickened and apparently moved to the east; meanwhile the northwestern segment of the sky was devoid of thunderstorm clouds, although shortly before the storm broke a confused mass of clouds appeared in that part of the sky. At about 4 p. m. the electrical display, which had hitherto been confined to the south and east, appeared in the northwest and very quickly thereafter

rain began. The winds before the storm were from the northwest and north, occasionally backing to northeast. Heavy rain began at 4:43 p. m. with the wind in the southeast; the rain slackened somewhat about 5 p. m. and the wind shifted to northwest, rain again becoming very heavy. From 4:43 to 5:43 p. m., 2.79 inches of rain fell, being the greatest amount for an hour ever recorded at the station. The total for the storm was 3.37 inches.

Inquiry as to the amount of rainfall at near-by points in Virginia appeared to show that the intensity of the storm in that State was much less than in the District of Columbia. At this juncture it was decided to make an inquiry as to the depth of rainfall and the progression of the storm in the adjoining States of Maryland and Virginia. The section directors for those States have supplied me with data on both points and I have fortunately been able to secure from the sewer department of the District of Columbia rainfall records for the storm as measured at 24 points, mostly within the populated area of the city of Washington. These records, in addition to two others maintained by the Weather Bureau, will give a distribution approximately of one rainfall station for each square mile of territory. Mr. J. B. Gordon, sanitary engineer, has supplied a sketch map of Washington upon which I have plotted the rainfall of the storm. (See Fig. 1.)

The catch of each gauge has been entered directly upon the map in the position occupied by the gauge. It will be seen at once that there were two areas of heavy rains one in the northeastern suburbs, as at Bennings, and the other in the southwest in the Rock Creek region. Between the two there is an area of diminished fall extending in a NNE-SSW direction with the minimum fall 1.85 inches at Congress Heights.

The least catch was but 65 per cent of the average for the District and the greatest was 139 per cent of the average, or a range from 39 per cent above to 35 per cent below, and this is probably not far from the normal expectancy in similar cases. So far as known, the only other point at which excessive rains fell in a short time was at Aberdeen, Md., and at Richmond, Va. The results shown on Figure 1 are of direct interest to city engineers and others interested in sewer construction.[1]

Progress of the storm.—It is not often possible to trace a single thunderstorm across a State, and the thunderstorms of July 13 were no exceptions to the rule. On the date in question at least two series of thunderstorms were observed, the first beginning in the extreme western counties of Maryland as early as 11 a. m. and progressing eastward or developing irregularly farther and farther east, the second apparently developed about 3:30 or 4 p. m., just west of Frederick County and progressed eastward and southward rather slowly until it reached Delaware Bay between 7 and 8 p. m.

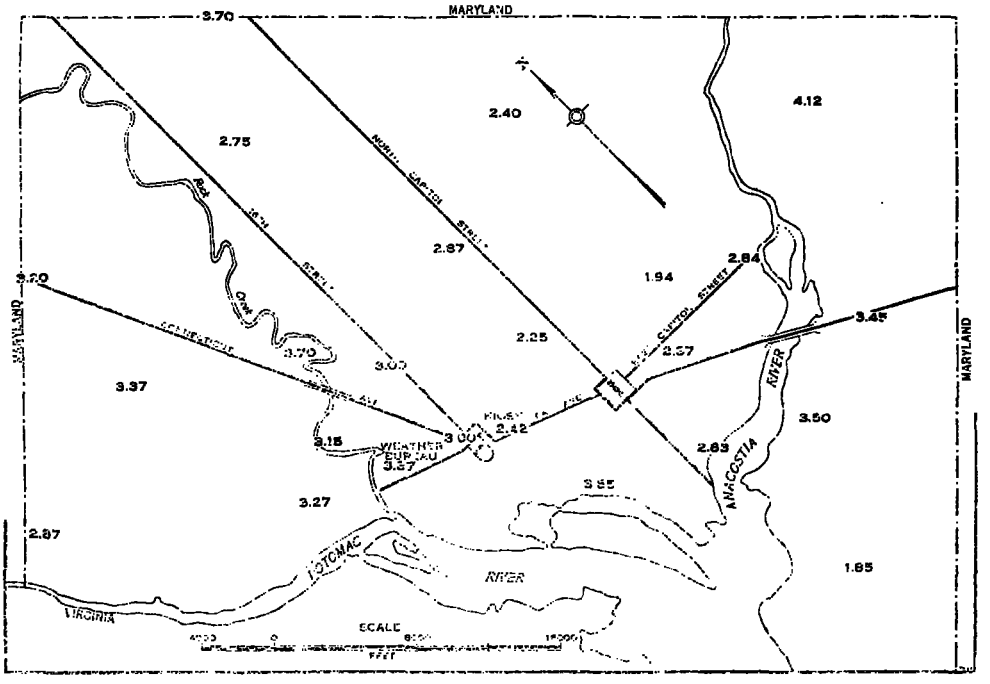

FIG. 1.—Precipitation in Washington, D. C. (inches), July 13, 1922.

In Virginia the earliest time of beginning was 3:20 p. m. at Mount Weather, in the extreme northwestern part of the State. In Loudoun County, directly east of Mount Weather, two stations report the beginning as at 4 p. m. At Washington, D. C., about 60 miles directly east, the beginning was at 4:05 p. m. Thunderstorms also began at the same hour at Charlottesville and Hopewell, Va., both points being in the south-central part of the State.

The times of beginning in both Maryland and Virginia points is shown in Table 1 on next page:

[1] Cf. The distribution of rainfall over restricted areas. MO. WEATHER REV., 49: 401–404.

TABLE 1.—*Time of beginning of thunderstorms in Maryland and Virginia, July 13, 1922.*

MARYLAND.

Station.	County.	Time of beginning.
Northern group:		
Friendsville	Garrett	11:00 a. m.
Frostburg	Allegany	1:00 p. m.
Cumberland	....do	12 noon
Clear Spring	Washington	2:30 p. m.
Chewsville	....do	4:00 p. m.
Keedysville	....do	4:00 p. m.
Frederick	Frederick	4:45 p. m.
Emmitsburg	....do	4:45 p. m.
Westminster	Carroll	2:00 p. m.
Freeland	Baltimore	2:00 p. m.
Darlington	Harford	9:30 p. m.
Falston	....do	8:00 p. m.
Aberdeen	....do	7:15 p. m.
Wilmington, Del	New Castle	5:00 p. m.
Cecilton	Cecil	5:00 p. m. D. N. p. m. [1]
Middle group:		
Boyds	Montgomery	3:00 p. m.
Great Falls	....do	3:30 p. m.
Takoma	....do	4:20 p. m.
Washington	District of Columbia	4:05 p. m.
College Park	Prince Georges	5:15 p. m.
Laurel	....do	D. D. p. m. [1]
Woodstock	Baltimore	2:00 p. m. D. N. p. m. [1]
Riderwood	....do	D. D. p. m. [1] 6:00 p. m.
Baltimore	....do	2:30 p. m. 7:03 p. m.
Sudlersville	Queen Anne	7:00 p. m.
Rock Hall	Kent	7:30 p. m.
Dover, Del	....do	5:30 p. m.
Southern group:		
Cheltenham	Prince Georges	4:30 p. m.
La Plata	Charles	5:30 p. m.
Ferry Landing	Calvert	1:00 p. m 6:30 p. m.
Solomons	....do	5:20 p. m.
Annapolis	Anne Arundel	5:00 p. m.
Ridgely	Caroline	6:00 p. m. D. N. p. m. [1]
Seaford, Del	Sussex	4:30 p. m.

VIRGINIA.

Northern group:		
Mount Weather	Clark	3:20 p. m.
Lincoln	Loudoun	4:00 p. m.
Arcola	....do	3:00 p. m.
Washington	District of Columbia	4:05 p. m.
Quantico	Prince William	4:55 p. m.
Middle group:		
Fredericksburg	Spotsylvania	5:30 p. m.
Charlottesville	Albemarle	4:00 p. m.
Mount Moriah	King George	6:00 p. m.
Southern Group:		
Columbia	Fluvanna	12:20 p. m.
Richmond	Henrico	6:40 p. m.
Hopewell	Prince George	4:00 p. m.
Runnymede	Surrey	5:00 p. m.
Newport News	Isle of Wight	7:30 p. m.
Langley Field	Elizabeth City	9:00 p. m.
Norfolk	Norfolk	2:20 p. m. 7:10 p. m.
Cape Henry	Princess Anne	1:40 p. m. 7:30 p. m.

[1] D. N.=During night; D. D.=During day. The stations are arranged according to geographic position beginning in the extreme northwest and proceeding due east, then returning to the west and proceeding east as before.

The evidence of the above table is not conclusive either for or against the idea of nonprogressive movement; it, however, seems to support the belief that thunderstorms developed east of the Blue Ridge in both Maryland and Virginia at approximately the same hour on the afternoon of the 13th and that the more vigorous of them moved east-southeast or due east. It is also clear that there were at least two distinct series of storms in both States and that the second one was the more violent of the two. The concentration of the heavy rainfall in one or two localities must be explained as due to local and favorable conditions at those points. Very heavy rain also fell in Maryland on the 20th, due to a barometric depression central on that date on the coast.

TORNADOES IN SOUTH DAKOTA, JULY 8, 1922.

By M. E. BLYSTONE.

[Weather Bureau, Huron, S. Dak.]

In the evening of July 8, 1922, two tornadoes occurred in rather close proximity near the southern border of South Dakota, one at St. Charles, Gregory County, which borders the Missouri River on the west, and the other on the southern shore of Lake Andes, Charles Mix County, which borders the Missouri River on the east. The distance apart was about 30 miles. That these were separate and distinct tornadoes seems to be shown by the fact that no destruction occurred between the two places, and by the further fact that the one at Lake Andes is reported to have occurred at 10 p. m. and the one at St. Charles at 10:15 p. m., while both moved in a generally eastward direction.

Both these tornadoes appear to have been of great violence. The one which occurred at Lake Andes came from the west. It missed the town of that name, but it destroyed about 20 summer cottages, 2 large dance halls, and 5 large barns on the south shore of the lake. Fifteen persons were injured, but no one was killed. The property loss is estimated at approximately $25,000. The loss to crops was slight. After causing this destruction the tornado apparently lifted and moved toward the southeast, dipping down again at a distance of about 1½ miles, but apparently causing no destruction. The débris lay toward the south, indicating that the buildings destroyed were on the northern side of the tornado. There was a funnel-shaped cloud.

The tornado at St. Charles was more destructive, possibly due to the fact that more buildings were in its path. This tornado is believed to have originated near Brocksburg, Nebr., about 15 miles southwest of St. Charles, where some barns were destroyed. However, it appears to have caused practically no destruction in South Dakota except at and near St. Charles. Practically all the buildings in St. Charles were destroyed or damaged. One grain elevator was upended and practically destroyed. Another near it was damaged only slightly. One lumber yard was destroyed and the lumber scattered. The total property loss is estimated at $150,000. One person was killed and nine were injured. There is no report that a funnel-shaped cloud was seen, probably due to darkness, but as the path of destruction did not extend beyond the limits of the town there seems to be no doubt but that the storm was a tornado.